

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (currently amended) A method for generating parametric audio output based on at least one of

a) interaction of a modulated ultrasonic carrier vibration with air as a non-linear medium of propagation, and b) interaction of a plurality of ultrasonic frequencies within air as a nonlinear medium, said method comprising the steps of:

a) generating an electronic signal comprising at least one of a) a modulated ultrasonic carrier signal, and b) at least two ultrasonic signals having a difference in frequency value which falls within an audio frequency range;

b) transferring the electronic signal to an electro acoustical transducer polymer film diaphragm which couples directly with the air as part of a single stage energy conversion process, said film being continuous over a length of at least ten wavelengths of the electrical signal at its lowest frequency value;

c) converting the electronic signal at the ~~film~~polymer film diaphragm directly to mechanical displacement, said ~~film~~polymer film acting as a driver member of a parametric speaker at an ultrasonic frequency of vibration; and

d) mechanically emitting the content of the electronic signal from the ~~film~~polymer film diaphragm into the air as ultrasonic compression waves which interact with the air medium to generate the parametric audio output.

2. (previously presented) A method as defined in claim 1, wherein step b) comprises the more specific step of transferring the electronic signal to an electrostatic film transducer.

3. (previously presented) A method as defined in claim 1, wherein step b) comprises the more specific step of transferring the electronic signal to an electret film transducer.
4. (currently amended) A method as defined in claim 1, wherein step b) comprises the more specific step of transferring the electronic signal to a thermally formed electro mechanical polymer film diaphragm as the electro acoustical transducer film diaphragm.
5. (currently amended) A method as defined in claim 1, wherein step b) comprises the more specific step of transferring the electronic signal to a piezo polymer film diaphragm as the electro acoustical transducer film diaphragm.
6. (currently amended) A method as defined in claim 1, wherein step b) comprises the more specific step of transferring the electronic signal to a planar magnetic polymer film diaphragm as the electro acoustical transducer film diaphragm.
7. (currently amended) A method as defined in claim 2, wherein step b) comprises the more specific step of transferring the electronic signal to an electrostatic backplate having a surface configuration comprising circular v grooves operable as a stator member with respect to the polymer film diaphragm.
8. (currently amended) A method as defined in claim 4, wherein step b) comprises the more specific step of transferring the electronic signal to a piezo polymer film diaphragm having a configuration of a rectified sine form.

9. (currently amended) A method as defined in claim 8, wherein step b) comprises the more specific step of transferring the electronic signal to a piezo polymer film diaphragm which is supported by a backplate having a configuration of a rectified sine form.
10. (currently amended) A method as defined in claim 4, wherein step b) comprises the more specific step of transferring the electronic signal to a piezo polymer film diaphragm having a configuration of a sinusoidal form.
11. (currently amended) A method as defined in claim 10, wherein step b) comprises the more specific step of transferring the electronic signal to a piezo polymer film diaphragm which is supported by a backplate having a configuration of a sinusoidal form.
12. (cancelled)
13. (cancelled)
14. (currently amended) A method as defined in claim 4, further comprising the step of selecting a transducer polymer film diaphragm having a convex curvature which generates a diffuse radiation pattern for emission of the parametric output.
15. (currently amended) A method as defined in claim 4, further comprising the step of selecting a transducer polymer film diaphragm having a concave curvature which generates a focused radiation

pattern for emission of the parametric output.

16. (currently amended) A method as defined in claim 4, further comprising the step of selecting a transducer polymer film diaphragm having a dipolar propagation mode for which generates a diffuse radiation pattern for emission of the parametric output.

17. (currently amended) A method as defined in claim 4, further comprising the step of spacing the transducer polymer film diaphragm a quarter wave distance from a supporting backplate.

18. (currently amended) A method as defined in claim 1, further comprising the step of selecting a transducer polymer film diaphragm having a one-half wave length distance at a carrier frequency between peak and trough of a sinusoidal form for the diaphragm.

19. (currently amended) A method as defined in claim 4, further comprising the step of providing a dimpled transducer film diaphragm comprising a monolithic sheet of polymer film having concave dimples in closely spaced, side by side array which generates a substantially uniform and homogenous radiation pattern for emission of the parametric output across the surface of the film diaphragm.

20. (currently amended) A speaker device for generating parametric audio output based on at least one of a) interaction of a modulated ultrasonic carrier vibration with air as a non-linear medium of propagation, and b) interaction of multiple ultrasonic frequencies within air as a nonlinear medium, said device comprising:

a) a parametric signal generation system including an ultrasonic signal source, an audio signal source, and a modulating device coupled to the ultrasonic and audio signal sources for mixing the ultrasonic and audio signals for generating a resultant electronic signal comprising at least one of a) a modulated ultrasonic carrier signal, and b) at least two ultrasonic signals having a difference in frequency value which falls within an audio frequency range;

b) an electro acoustical transducer polymer film diaphragm coupled to the parametric signal generation system which also couples directly with the air as part of a single stage energy conversion process, said polymer film diaphragm being large with respect to the lowest ultrasonic frequency used and having a dimension at least ten times the wavelength at said frequency ; and

c) support structure for positioning and stabilizing the film diaphragm to enable mechanical displacement of the polymer film diaphragm as a driver member of a parametric speaker.

21. (currently amended) A device as defined in claim 20, wherein the transducer polymer film diaphragm comprises an electrostatic transducer.

22. (currently amended) A device as defined in claim 20, wherein the transducer polymer film diaphragm comprises an electret transducer.

23. (currently amended) A device as defined in claim 20, wherein the transducer polymer film diaphragm comprises a piezo film diaphragm as the electro acoustical transducer film diaphragm.

24. (currently amended) A device as defined in claim 20, wherein the transducer polymer film diaphragm comprises a thermally formed electro mechanical film diaphragm as the electro

acoustical transducer film diaphragm.

25. (currently amended) A device as defined in claim 20, wherein the polymer transducer film diaphragm comprises a magnetic film diaphragm as the electro acoustical transducer film diaphragm.

26. (canceled)

27. (previously presented) A method as defined in claim 1, wherein step b) comprises the more specific step of transferring the electronic signal to a polyvinylidene di-fluoride (PVDF) diaphragm as the electro acoustical transducer film diaphragm.

28. (canceled)

29. (previously presented) A device as defined in claim 20, wherein the transducer film diaphragm further comprises a polyvinylidene di-fluoride (PVDF) diaphragm as the electro acoustical transducer film diaphragm to emit ultrasonic signals.

30. (currently amended) A method for enabling parametric generation of audio output in an air medium, the method comprising the steps of:

providing for parametrically creating an audio frequency range sound output in air based on an audio input signal by means of a higher frequency carrier vibration in the air medium, further comprising at least one of: a) modulating a higher frequency carrier signal; and, b) combining a plurality of higher frequency signals;

facilitating generating at least one electronic signal ~~that can give rise to creation of~~ configured to provide an audio frequency range sound output in an air medium by interaction of sound waves from said higher frequency vibration with the air medium;

enabling transference of the electronic signal to a transducer including a thin polymer film that is coupled directly to the air medium, said thin polymer film being relatively large

compared to ultrasonic frequency wavelengths and having a dimension at least ten times the wavelength of the lowest frequency of the higher frequency carrier vibration to be used;

enabling conversion of the electronic signal at the diaphragm directly to vibration of the air medium by means of movement of the polymer film thereby facilitating creation of a parametric audio frequency range sound output in air from the higher frequency carrier vibrations of air imparted by the film.

31. (currently amended) A method as set forth in claim 30, further comprising the step of providing said thin polymer film as part of a transducer selected from the group of types consisting of: electrostatic; electret; piezo-electric; and planar-magnetic.

32. (currently amended) A method as set forth in claim 30, further comprising the step of providing the polymer film with a plurality of curved surface portions which sized to be not more than a wavelength of the lowest frequency of the higher frequency to be used across a narrowest dimension.

33. (currently amended) A method as set forth in claim 32, comprising the further step of thermo-forming the curved portions of the polymer film.

34. (currently amended) A method as set forth in claim 33, comprising the further step of providing a support substrate including ridges to which the polymer film is attached between curved portions.

35. (previously presented) A method as set forth in claim 32, further comprising the step of configuring the curved portions in one of a sinusoidal and a rectified sinusoidal shape.

36. (currently amended) A method as set forth in claim 30, comprising the further steps of providing the polymer film as part of a piezoelectric transducer, wherein the film is electrically responsive;

configuring the polymer film to have at least one curved portion, facilitating audio

reproduction when the polymer film responds dimensionally to an electrical signal.

37. (currently amended) A method as set forth in claim 36, wherein the polymer film is pressure biased.

38. (currently amended) An apparatus for parametric reproduction of audio program material in an air medium, comprising:

a signal source configured to generate a parametric electronic signal at a higher frequency range which is based on at least one higher frequency carrier signal and at least one audio program signal;

an emitter operably coupled to the signal source, the emitter further comprising a large area film structure which is at least ten wavelengths of the carrier signal at its lowest continuously operating frequency, including a thin polymer film in contact with the air medium disposed over essentially all of an area of said large area film structure, said thin polymer film thus being directly coupled to the air medium, the emitter being configured to impart higher frequency sound waves into the air medium, which sound waves in turn give rise to audio frequency range sound output created within the air medium by interaction of the higher frequency range sound output with the air medium, which audio frequency range sound output reproduces the audio program material sought to be reproduced.

39. (previously presented) An apparatus as set forth in claim 38, wherein the emitter including said film structure is selected from the group of types consisting of: electrostatic; electret; piezoelectric; and planar-magnetic.

40. (previously presented) An apparatus as set forth in claim 38, wherein the emitter further comprises a back plate which cooperates with the film structure, said back plate having areas in contact with the film structure and areas not in contact with the film structure.

41. (currently amended) An apparatus as set forth in claim 40, wherein the polymer film is an electrically responsive film.

42. (previously presented) An apparatus as set forth in claim 41 wherein the emitter is of the piezoelectric type.

43. (previously presented) An apparatus as set forth in claim 42, wherein the film structure is pressure biased.

44. (currently amended) An apparatus as set forth in claim 38, wherein the polymer film includes a plurality of curved portions.

45. (previously presented) An apparatus as set forth in claim 44, wherein the curved portions have a shape that is one of sinusoidal and rectified sinusoidal.

46. (currently amended) A parametric emitter system, comprising:

A signal source configured to actuate a parametric emitter to parametrically generate an audio frequency range audio output in an air medium in accordance with a parametric electronic signal which is a higher frequency signal based on an audio frequency range signal containing audio program material to be reproduced when said parametric electronic signal is passed to the emitter;

An emitter configured to generate said audio frequency range audio output in the air medium from a higher frequency vibrational output, further comprising a thin polymer film diaphragm structure, said structure being in direct contact with the air medium and sized so that it is large enough in comparison to the lowest higher frequency vibrational output wavelength to be created that the higher frequency vibrational movement of the diaphragm creates a beam, in which beam audio-range sound output is created and outside of which audio frequency range output is not created.

47. (currently amended) An apparatus as set forth in claim 46, wherein the emitter including said polymer film structure is selected from the group of types consisting of: electrostatic; electret; piezoelectric; and planar-magnetic.

48. (currently amended) An apparatus as set forth in claim 46, wherein the polymer film structure is continuous over a distance of at least ten wavelengths of the higher frequency signal at its lowest operating frequency.

49. (currently amended) An apparatus as set forth in claim 48, wherein the emitter comprises a back plate and the polymer film structure is attached to the back plate at a multiplicity of locations and is free to move at a multiplicity of locations.

50. (currently amended) An apparatus as set forth in claim 46, wherein the polymer film structure is pressure biased.

51. (currently amended) An apparatus as set forth in claim 46, wherein the polymer film includes a plurality of curved portions.

52. (previously presented) An apparatus as set forth in claim 51, wherein the curved portions have a shape that is one of sinusoidal and rectified sinusoidal.

53. (currently amended) A method of creating a beam of audio frequency sound in an air medium, comprising:

providing a parametric signal source;

creating a parametric electronic signal so as to be available at said source which is at least one of a modulated higher frequency carrier signal and a plurality of higher frequency signals which contain audio program information to be reproduced at a lower frequency in the beam in the air medium;

providing a parametric emitter which comprises a thin polymer film which is directly coupled to the air medium, said polymer film being large compared to a lowest operating frequency wavelength to be reproduced based on the parametric electronic signal and at least ten wavelengths at said lowest operating frequency across said polymer film in at least one dimension;

configuring the emitter to connect to and receive the parametric electronic signal from the parametric signal source; and,
parametrically generating the beam of audio frequency sound in the air medium.

54. (previously presented) A method as set forth in claim 53, further comprising the step of providing said emitter selected from the group of emitter types consisting of: electrostatic; electret; piezoelectric; and planar-magnetic.

55. (currently amended) A method as set forth in claim 54, comprising providing an undulating surface of said polymer film, including closely spaced concave portions.

56. (currently amended) A method as set forth in claim 55, wherein the step of providing includes selecting an emitter of the piezoelectric type, and further comprising the step of pressure biasing the thin polymer film.

57. (currently amended) A method as set forth in claim 53, further comprising the step of selecting a thin polymer film which comprises a polyvinylidene difluoride material.

58. (currently amended) A method as set forth in claim 53, further comprising the step of forming at least one of a convex curvature and a concave curvature in the thin polymer film.

59. (previously presented) An apparatus as set forth in claim 58, wherein a curvature has a shape that is sinusoidal.